

ON THE RADULÆ OF THE BRITISH HELICIDS. (PART I.)

By Rev. E. W. BOWELL, M.A.

Read 8th May, 1908.

SOME few years back English malacologists were distinguished for the persistency with which they retained "the old genus *Helix*," and refused to accept, for ordinary use, the various subdivisions which have been made by writers dealing with larger faunas. In other branches of zoology there has been a similar unwillingness to narrow the genera to which Linnæus gave the classical name of the animal. But it now seems to be generally recognized that our *Helices* form the local representatives of a family rather than of a genus, and the system of nomenclature used by Mr. B. B. Woodward in his paper read before the Conchological Society on January 14th, 1903, is familiar to all conchologists.

It is the object of this paper to suggest that the study of the radulæ of *Helicids* affords a means of estimating the importance of the subdivisions of the old genus *Helix*. Some possible misconceptions of this view are here to be anticipated. *The actual number of the teeth on any given radula may be a matter of comparatively little importance*; certainly some of the estimates given in the older literature of the subject are at variance with ordinary fact, just as the measurements of shells have in many cases been shown to be. It becomes a question how many of the extreme marginal rows shall be counted as teeth; and in some forms (e.g. *Planorbis*), though not conspicuously in the *Helicids*, this is a very difficult question, owing to the presence of numerous rows that consist of basal plates only. Again, the number of teeth at the growing end of the organ, that are reckoned as existent, will largely depend upon the operator and his methods and instruments, and if it be thought necessary to take all into account that are just beginning to be teeth, one will have to add six or seven transverse rows to the ordinary computations. The imperfect rows which always occur at the front or older end of the radula must not be considered as the representatives of complete rows that have formerly existed; they form a valuable index of the actual number of rows that existed in the embryonic or sub-embryonic stage of the animal's life. Another point that sometimes causes unnecessary perplexity is the question of the existence or non-existence of an endocone when that part of the tooth is apparently reduced to a mere corner, which may be more or less clearly demonstrated by using various kinds of illumination. In all the *Pulmonata* that have come under my notice, with the exception of the *Testacellidæ* and the *Physidæ*, each lateral tooth possesses a central cusp which is flanked by the more or less prominent folds called ectocone and endocone. The point of first importance to consider seems to be whether this central cusp is itself single, as is generally the case, or double, as in the larger species of *Vitrea* (laterals) and *Helix* s.s. (marginal), or *Vitrina* (both lat. and marg.). In the group now under notice the prevailing characteristic

is the presence of a deposit of chitin which more or less completely fuses the central cusp with the 'endocone' in the adult radula; the earlier condition, in which these two were markedly separate, may be seen in the embryo, and in the skeleton teeth at the growing end. Relatively to the basal plates, the teeth are always turned inwards, except in the case of the central tooth. Hence there is always a tendency for the endoconic fold to become hidden and obliterated, and for the ectoconic one to assume greater importance. This latter factor is especially noticeable in small species; in the larger ones the tongue tends to become wide and flattened, and consequently the distinction between the central and lateral teeth is less and less marked. A mechanical reason for this may be found in the fact that the actual size of the teeth does not vary uniformly with the actual size of the animal.

The radula of *Punctum pygmæum* is totally unlike those of the true Helicids; but it is evidently very near to the type prevailing in the Succineidæ. The laterals and marginals are multicuspid, the two larger cusps representing the mesocone. The teeth are long and pointed. *Carychium minimum* presents a very similar state of things, but is much closer to the type prevailing in the Succineidæ. It may be worth mentioning that *Carychium* has a maxilla composed of separate plates, very much like that of a small *Planorbis*. The radula of *Vertigo Moulinsiana* is of the same type as that of *Punctum*.

Pyramidula rupestris is an almost exact copy, on a very small scale, of *Chilotrema lapicida*. It has not the slightest resemblance to *P. rotundata*. This latter species has a radula very easily distinguished from those of other Helicids, and apparently it is an earlier form; for it unites some features (tendency to multicuspid marginals, especially in young examples) which remind us of the Pupidæ, with a general facies like that of the group next to be considered. I am here speaking entirely of the radula, neglecting for the occasion our other sources of information bearing upon phylogeny. In the sequel I hope to make some suggestions as to their relative importance.

The next group, judging by the radula, is a large one. It will include *virgata*, *Itala*, *caperata*, *cantiana*, *granulata*, *hispida*, *sericea*, *revelata*, and *rufescens*. These are all very much alike; the differences which divide them are not greater than those which divide the group of large species of *Vitrea* which have lately been so much under consideration. All of them show a strong resemblance to the Arionidæ, especially to *A. hortensis*. Here the mesocone in the marginals is represented by a single point, shaped like the blade of a pocket-knife. In other particulars they show an approximation to the true Helices—if such a phrase may be allowed.

Cochlicella barbara presents a radula as anomalous as the rest of its structure. It even possesses slightly bifid marginal mesocones; while there is also present a tendency to pectinate form in the extreme marginals that suggests relationship with the Pupidæ.

Hygromia fusca appears to be out of place. Its radula is very distinctive, but evidently has affinities with those of *lapicida*, *arbustorum*, *rupestris*, and (more distantly) of *obvolvata*.

Acanthinula aculeata resembles *Vallonia* except in the possession of a very much greater number of laterals. The marginals in these (three or more?) species are regular little combs, and quite similar to those found in the Vertiginidæ. Several varieties of *Vallonia* occurring in this country possess distinct forms of radulæ; they have a great tendency to asymmetric laterals, one or two rows being enlarged at the expense of the others. The laterals of *aculeata* are exceptionally regular—another instance of character inversion in closely allied species.

Helicodonta obvoluta is distinguished by the unusual angularity of the cusps throughout the radula; they form a pattern very suggestive of holly-leaves. In *Helicigona lapicida*, on the contrary, every cusp is rounded off, almost squared off; but the teeth do not appear to be exceptionally strong in build. Yet their general disposition is similar to that seen in *Helicodonta*; it might be supposed that (with those of *fusca*?) they were the prototypes of the true Helices.

The radula of *arbutorum* seems intermediate between these (*Helicigona*) and those of the true Helices. The tendency is towards the latter, but they are still quite separate from them.

Of the remaining species, *aspersa*, *pomatia*, *nemoralis*, *hortensis*, and *Pisana*, it may be said that they form a very well-defined group, easily separable at once from the others. The marginal mesocone is always pronouncedly blunt and bifid, resembling a little hand with an extra thick thumb, the fingers being apposed. Each of these five species may be distinguished by special points of minor importance, but their general resemblance is great. The South European group, of which *splendida* is an example, also belongs here.

According to this evidence, *Helicella* and *Hygromia* would be classed together, or regarded as closely allied, excluding *barbara* as a form archaic or aberrant, and *fusca* as being plainly near to *Helicigona* and *Helix* (s.s.). To the group of minor Helices, distinguished by Arionid radulæ, *rotundata* may perhaps be added. *Acanthinula* and *Vallonia* are close together, and closer to the Vertiginids than to any Helicids. *Helix* (s.s.) remains a well-marked group, and its relationship to *Helicigona* is certain. *Helicigona* should include *rupestris*, and *Punctum pygmæum* may remain in the Endodontidæ.

These suggestions are made solely on the evidence arising from the radulæ, and I should be the last person to neglect the other evidence, derived from shell, maxilla, diverticula of reproductive system, and even from geographical distribution. But I put them forward here in order to show that the comparative study of radulæ may be a great help to systematic malacology or conchology. The radula is a comparatively hard and unalterable organ, and its characters are more constant than those of the diverticula above mentioned, the functions and physiology of which (not to mention their embryology) are still for the most part unknown.

(To be continued.)
